DOCUMENT RESUME

ED 158 417 EA 010 845

AUTHOR Hansen, W. Lee; Nelson, F. Howard
TITLE The Distributional Efficiency of Benefits for a Student Financing Program with Payment Obligations Contingent Upon Future Income. Reprint Series, 272.
INSTITUTION Wisconsin Univ., Madison. Inst. for Research on Poverty.
PUB DATE 76
NOTE 21p.; Not available in paper copy due to small print of original document

EDRS PRICE MF-$0.83 Plus Postage. HC Not Available from EDRS.
DESCRIPTORS Higher Education; Income Contingent Loans; Loan Repayment; Program Descriptions; State Aid; *Student Loan Programs; Tables (Data)
IDENTIFIERS *Wisconsin

ABSTRACT

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THE DISTRIBUTIONAL EFFICIENCY OF BENEFITS FOR A STUDENT FINANCING PROGRAM WITH PAYMENT OBLIGATIONS CONTINGENT UPON FUTURE INCOME

W. Lee Hansen and F. Howard Nelson

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The Distributional Efficiency of Benefits for a Student Financing Program With Payment Obligations Contingent Upon Future Income†

W. LEE HANSEN AND F. HOWARD NELSON*

The purpose of this paper is to describe the broad outlines of a new student financing program proposed by the State of Wisconsin, and to present illustrative data on the distribution of its benefits. The results presented here are not only preliminary, but they are also partial inasmuch as we are just beginning a systematic evaluation of this program. Several things make our undertaking an attractive one—the unique features of the program, the fact that it is receiving consideration in a state which has played an important leadership role in the financing of higher education, and our hope that we can make a substantial addition to the relatively limited research findings available on the effects of income contingent provisions in student financial aid programs.

The recent spate of reports on higher education finance by the Carnegie Commission, the Committee on Economic Development, and the National Commission on Postsecondary Finance have already set off a new debate on how to finance higher education and on who should pay and who should benefit.[1] Traditionally, and in these reports as well, much of the discussion has focused on the appropriate level of tuition and the optimal distribution of grants to students. But just when some limited agreement is being reached on these points, we may be witnessing the beginning of a profound change in the approach to higher education finance, arising out of the push toward greater student "independence", following on the heels of age of majority legislation. This change could well undermine the traditional methods of finance which assume that parents have an obligation to assist their offspring in financing the costs of postsecondary education. If the age of majority legislation is intended to shape public policy, changes in the traditional methods of financing may be desirable. As

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† Financial support for this study was provided in part by the Institute for Research on Poverty, University of Wisconsin-Madison, through funds provided by the Office of Economic Opportunity pursuant to the provisions of the Economic Opportunity Act of 1964.

[1] Carnegie Commission on Higher Education, *Higher Education: Who Pays? Who Benefits? Who Should Pay?* McGraw-Hill Book Company, June 1973; Committee for Economic Development, *The Management and Financing of Colleges*, October 1973; and National Commission on the Financing of Postsecondary Education, *Financing Postsecondary Education in the Last Quarter of the Twentieth Century*, U.S. Government Printing Office, 1974.

students come to regard themselves as independent of their parents, and, therefore, as qualified for financial aid based on their own very limited resources, the present system of financing will have to adjust in some as yet unforeseen way.

In addition to the move toward greater student independence, the rapid escalation in educational costs over the past few years is making it more difficult for many young people to participate in postsecondary education, with or without parental help. On the assumption that higher education is no less valuable than it was just a few years ago, we must ask how the large and growing gap between student financial needs and financial resources can be reduced, if not eliminated altogether.

An expansion of capital resources for investment in higher education and a restructuring of programs allocating these resources seems to be the principal answer. Nearly half of all student financial aid as it is presently structured takes the form of educational loans. The repayment of these loans can be viewed as a tax on future income. Given that there will continue to exist dependence on loan markets, the "tax" on future incomes should be structured on the same equity and efficiency principals used in evaluating explicit taxes. In addition to expanding capital resources for investment in higher education there is a need to increase the amount of resources that can be loaned to individual students. But there must also be a lengthening of the time period over which students can discharge their obligations. In short, there is need to gear repayments to the amount advanced to them for that education. Mutualized income contingent loan programs, now being tested at various private universities, attempt to do some of these things. However, less restrictive alternatives can be provided through public, externally subsidized student financing programs based on an income contingent concept of the kind currently under review in the State of Wisconsin.

Our mode of analysis in this paper will be conventional by economists' standards. First, we are interested in the economic efficiency of the proposed program, relative, of course, to the existing melange of programs. By efficiency we refer to the economic effects of the proposal, the net benefits relative to the next best alternative. Second, we are interested in the equity of the proposal, the extent to which this proposal's distributional effects differ from existing programs; specifically, we are talking about shifts in who gets the net benefits from the new program. Because of the preliminary nature of our work, we cannot promise any definitive results.

The paper is divided into four parts. Part I discusses the efficiency and equity questions which are at issue. Part II summarizes the Wisconsin proposal and notes the principal objections to it. Part III offers some of our first findings as to how the subsidies of this program would be distributed among various population groups. And Part IV indicates the next steps in our research program.

I. Efficiency and Equity of the Proposal

In the introductory section we noted our concern with the efficiency and equity effects of the program under consideration. As in the evaluation of most proposals, these two broad classes of effects are difficult to separate. It may be helpful, therefore, to indicate the specific effects of interest to us, and to comment on them in light of the broader concepts of efficiency and equity.[2]

Several types of effects are of interest to us. First, an important reason for advancing alternative proposals for financing higher education is that such proposals will affect "access", by changing the number of students and at the same time shifting their distri-

[2] Hansen, W. Lee, "Equity and the Finance of Higher Education," *Journal of Political Economy*, Vol. 80, No. 3, pp. S260-S274.

bution among individuals classified by various characteristics, e.g., by size of family income, sex, race, and so forth. Most proposals would seek to enlarge access but would put special emphasis on increasing access for those young people who are most qualified to benefit from higher education but cannot participate because of limited resources. While wider access would indicate a shift toward greater equity, economic efficiency might also be increased as those individuals who could benefit substantially from post-secondary education were brought into the system.

A second effect of interest is the impact on the public budget. States already provide extensive subsidies for higher education. If a new proposal is to cost more money it is likely that either taxes must be raised or offsetting reductions in other programs must occur. On the assumption that taxes will rise, it is important to know by how much they will increase and who will bear the burden of the increase. Again, we find that both efficiency and equity are at issue. On the other hand, if the added costs of a new program cause the displacement of an existing program, and if the additional benefits relative to the additional costs of the new program are greater than the decline in benefits relative to costs of the curtailed program, then it will be economically efficient to proceed with the new program. However, because different groups will be affected as a new program replaces a current program, there will be distributional consequences. Thus, a relatively more efficient program may be instituted but its distributional effects may be relatively adverse.

A third effect is to look explicitly at the distribution of the subsidies under the proposed program and under the present system. Do the subsidies go to assist those who are most or least in current need of augmented resources? Do the subsidies go to people who in the light of subsequent earning experience most or least need the subsidies provided? These are questions of great interest because they get to the heart of the distributional issues which inevitably are discussed.

Less amenable to analysis is a fourth type of effect, that pertaining to potential changes in behavior by the affected groups—students, their parents, and educational institutions. Will changing the financial arrangements cause students to approach their academic work in a different manner and thereby alter the way post-secondary education affects the future activities of students—their participation in the work force, their earnings, etc.? Similarly, will institutions alter their behavior, as it affects their selection and retention procedures, the content of their educational programs, and the like? In short, the behavior of all the participating units may at the margin change somewhat. One would hope that some judgments might be made about whether these changes are positive or negative in their impact on efficiency and equity.

Finally, there is the issue of the overall intergenerational effects of any shift in the method of financing higher education. The intergenerational effects have been least explored in the literature; yet they are potentially the most important of all the issues discussed.[3] We know that expenditures on higher education are one of the several ways by which wealth is transmitted from generation to generation, the alternatives being cash transfers and inheritance. But education may have greater merit in the eyes of many parents because it is something that cannot be taken away from their offspring; moreover, it permits parents to place a distinctive stamp of their own values and lifestyle on their offspring. And so we must ask how any new proposal will affect the intergenerational

[3] *Ibid.* Hartman, Robert W., "Equity Implications of State Tuition Policy and Student Loans," *Journal of Political Economy*, Vol. 80, No. 3, pp. S142-S177; Peckman, Joseph A., "Note on the Intergenerational Transfer of Public Higher Education Benefits," *Journal of Political Economy*, Vol. 80, No. 3, pp. S256-S260; Hansen, W. Lee, *op. cit.*

transmission of wealth and status. Moreover, to the extent that a proposal facilitates shifting more of the cost from the parents to the student and facilitates shifting it forward in time, this will create a special period of transition. Thus, one of our major objectives is to explore the intergenerational effects of the new financing proposal, and to look specifically at how the longitudinal distribution of subsidies will shift as such a program is implemented.

II. The Wisconsin Guaranteed Higher Education Plan[4]

A. Origins of the Proposal

The Wisconsin Guaranteed Higher Education Plan originated in response to three forces: the impact of the 18 year old age-of-majority on existing programs, the educational cost concerns of middle income families, and the growing need for student financial aid in the face of increasing competition for the tax dollar.

The State's 18 year old age-of-majority legislation can be viewed as transforming the public post-secondary education system from a child-oriented to an adult-oriented system. *In loco parentis* no longer exists. Students have the right to vote, enter into debts, and the like. Moreover, new legislation makes everyone over age 18, including students, eligible for State Homestead tax relief. As yet, no substantial change has occurred in the way students are financed. The continued dependence on parental financial resources raises many long-standing questions of equity. It also raises an important legal question, for it is difficult to find precedent for making participation by adults in a public program contingent upon the financial capacity of the adults' parents.

While the legal implications of the 18 year old age of majority are ambiguous and must ultimately be clarified by the courts, the policy implications underlying the legislation are clear. Even if the courts resolve the legal issues in a way favorable to the traditional method of student financing, the trend towards more and more students regarding themselves as independent of their parents is likely to continue.[5] Were all students viewed as completely independent, the amount of calculated student financial need would increase tremendously. Given the limited financial aid funds now available, there would be great difficulty in devising a fair way of distributing these funds. Alternatively, substantial additional funds for aid programs would have to be provided tax-payers.

After a period of rapid growth, the rise in post-secondary expenditures has slowed down, in part, because of increased competition for dollars by other programs. This has generated growing pressures to target expenditures in such a way as to achieve maximum effectiveness. The existing system of financial aids which bases aid on current parental resources is viewed by many as doing this. Yet it can also be argued that grants should be targeted to the outcomes of higher education, the student's future experience, as reflected by how well his education pays off in future earning power. The rationale of this argument is that financial aid should not be given to those who benefit greatly from higher education despite low parental resources and that subsidies should be larger for groups facing discrimination in the labor market and whose returns to higher education will be lower, e.g., women, blacks, etc.

The third major concern is the middle class taxpayer upon whom the present financing

[4] This section draws heavily on: State of Wisconsin Higher Educational Aids Board, "Status of the Wisconsin Guaranteed Higher Education Plan," Board Report #74-16, March 1974; and "Wisconsin Guaranteed Higher Education Plan," November 1973.

[5] See W. Lee Hansen and Robert J. Lampman, "Basic Opportunity Grants for Higher Education: Will the Outcome Differ from the Intent?," *Challenge Magazine*, Nov./Dec. 1974, pp. 46-50.

structure depends. As presently constituted, student need-based financial aid programs generally exclude middle income families from participation. The only substantial post-secondary assistance received is that of low tuition. Indeed, the strong objection raised nationally against recommendations for higher tuitions is primarily an expression of middle class concern. Therefore, any basic change in the student financial aid structure and higher education financing which does not take into account middle class families will probably have little chance of obtaining legislative success.

B. Major Provisions.

The Wisconsin Guaranteed Higher Education Program is still in the developmental stages but enough of its key provisions are known to make possible some preliminary analyses. The major provisions are as follows:

—The State of Wisconsin would advance to all students the amount needed for tuition and standard living costs to pursue a post-secondary education of their choice with repayments to be made on an income contingent basis and spread over a longer period of up to 25 years.

—If the annual increment in interest exceeds the annual repayment, the difference would be assumed by the State of Wisconsin as an interest subsidy. Interest rates would not be subsidized. After 25 years all remaining obligations would be waived to insure low earnings protection.

—Students would have two options in determining their financial need: (a) the family's financial status as defined by the traditional need analysis system, or (b) the student's personal financial status, following an emancipation statement signed by the student. Under (a) any student from a low income family would qualify for whatever grants were available, as well as whatever additional loans might be needed; state grants would be available only to these students. Under (b) an assessment of student financial need would be made, irrespective of parental income and resources, but these students would only be eligible for advances subject to repayment contingent on income that include low earnings protection provisions.

Students would be expected to repay only what had been advanced to them, plus interest. The maximum repayment period is 25 years, with all remaining debt being cancelled at that time, the loss being borne by the State. Borrowers with high incomes would not have to repay more than the true value of their loan.

Finally, the State would maintain its current level of tuition subsidies, set at approximately 25 percent of total instructional cost for each level of instruction.

Key provisions are still under consideration such as repayment rate, the appropriate income base, treatment of the low earning spouse, and various forms of subsidization. There has been a tendency to favor repayment rates that vary progressively with income rather than the usual constant percentage of income per $1,000 borrowed characteristic of conventional income contingent loan programs. Adjusted Gross Income is the most frequently mentioned income base. The treatment of the low earning spouse remains to be decided.

It is anticipated that this program would be integrated with existing Federal grant programs. After availing themselves of Federal financial aid opportunities, students would be eligible for participation in the state program. At the Federal level Basic Opportunity Grants are available for both dependent and independent students. Federal participation in the state loan program would be secured, assuming no change occurs in the present federal programs, through the use of a dual promissory note; the State would repay the traditional notes of the Federal loan programs for the stu-

dent and the student would repay according to the income contingent provisions of the state loan program. This would insure the availability of Federal interest subsidies and make available Federal sources of capital while simultaneously maintaining important income contingent provisions, such as longer repayment periods.

C. Reactions to the Proposal.

As might be expected, opposition to the proposal has been widespread. Public university officials have been cautiously neutral in some cases but more often vigorously in opposition. The reasons are several. First, the availability of a program providing funds for all uncovered costs open to all students is seen as the first step in a larger effort to raise tuition to some higher level—the one-third to one-half of full cost argued for by the Carnegie and CED reports. In addition to the fact that higher tuition runs counter to the land-grant tradition of low tuition, there appears to be a suspicion that demand is not necessarily highly inelastic; if tuition were raised relative to tuition for other schools, enrollments would decline. With such a decline would come reductions in state funding. Second, it is argued that the burden of financing higher education will thus be shifted from the older generation to the generation which gains most directly. This is viewed negatively, as a renunciation of an historical relationship that has apparently worked well in the past. Third, since the proposal calls for eliminating some portion of existing state programs, it is feared that low income and minority students would be discouraged from enrolling due to cultural biases against borrowing, notwithstanding the substantial low earnings protection provision of the program. Fourth, it is alleged that any program of the scale proposed would give rise to a new bureaucracy and entail great costs. And finally, critics question the basic premises on which the proposal builds, namely, the middle class revolt, the age of majority issue, and the limited availability of resources. In short, as with any program, numerous objections can be raised. We do not intend to refute these objections; we only wanted to get them out on the table inasmuch as we will not have time to deal with them in this paper.

III. Preliminary Analysis of Plan

There already exists a sizable body of theoretical and empirical work dealing with income contingent loans.[6] The bulk of it is concerned with technical issues such as the maximum repayment period, the income base of borrowers, opt-out rates, interest rates charged to the students, the repayment rate necessary to insure financial self sufficiency, and macroeconomic effects. The Dresch-Goldberg study, for example, focused on the internal mechanics of an income contingent loan program such as the tradeoff between the repayment rate, the maximum repayment period and the opt-out rate. All of these issues are crucially important inasmuch as they relate to the proposed program and will need considerable attention if this program is to be implemented.

Our major concerns, however, touch upon issues that have received only passing attention, such as the impact of alternative repayments rates on subsidy incidence, the distribution of subsidies providing low earnings

[6] Dresch, Stephen P., and Robert D. Goldberg, "Variable Term Loans for Higher Education, Analytics and Empirics," *Journal of Economic and Social Measurement*, pp. 59-92, January 1972; Hartman, Robert W., *Credit for College*, Carnegie Commission on Higher Education, McGraw-Hill Book Company, 1971; Johnstone, D. Bruce, *New Patterns for College Lending:Income Contingent Loans*, Columbia Press, 1972; Shell, Karl, Franklin M. Fisher, Duncan K. Foley, and Ann F. Friedlander, "The Educational Opportunity Bank: An Economic Analysis of a Contingent Repayment Loan Program for Higher Education," *National Tax Journal*, Vol. 21, No. 1, pp. 2-45, March 1968.

protection among students classified by future income, race, sex and occupational status, and the effects on access of alternative repayment rates and subsidization schemes. Our major purpose in this section is to sketch out various repayment schedules and to see what they imply with respect to the distribution of subsidies by the future incomes of the participants.

A. Alternative Repayment Plans

1) Constant Marginal Repayment Rate (CMR). One possible repayment rate frequently used in the literature and implemented in actual programs, such as Yale's, is the constant rate, expressed as a percentage of income per $1,000 advanced, irrespective of the advance or income size.

2) Diminishing Marginal Repayment (DMR). This repayment schedule specifies a decreasing percentage of income for each additional $1,000 advanced. The rationale for such a repayment schedule is that the student prefers high annual payments and a shorter repayment period for smaller obligations and lower annual repayments and a longer repayment period for larger obligations. In addition, program managers prefer this because the quick liquidation of small loans lowers administrative costs which are invariant with advance size. Table I is an example of a diminishing marginal repayment rate.

3) Straight Income Repayment Rate (SIR). Under this repayment schedule the annual repayment varies only with income and not the amount advanced. One example of the formula is r= .04 x AGI - $100. The $100 "credit" makes the repayments vary progressively with income. Like the DMR, small advances are liquidated rapidly while the burden of large advances is spread over a longer period of time. Support for this plan would come from those who believe the annual repayment obligation should and need not depend on the initial need of the participant as measured by the size of the advance.

4) Income Progressive Repayment Rate (IPR). This plan specifies a repayment schedule that varies progressively with the income of the borrower. An example of a possible repayment formula is .0075 x AGI - $20, where the $20 "credit" adds the element of progressivity with respect to income. Some combination of DMR and IPR would insure more rapid repayment as income increased and the size of the original debt decreased.

B. Types of Subsidies.

1) Principal Subsidy. This subsidy is provided to those individuals whose repayments have been insufficient to repay the principal and accrued interest during the maximum repayment period of 25 years.

TABLE I

Schedule of Diminishing Marginal Repayment Rates

Amounts Advanced	Marginal Repayment Rate	Cumulative Repayment Rate	Cumulative Rate per $1,000 Advanced
1st $1,000	2.0%	2.0%	2.0%
2nd $1,000	1.0	3.0	1.5
3rd $1,000	0.5	3.5	1.166
4th $1,000	0.25	3.75	0.9375
5th $1,000	0.25	4.0	0.8
6th $1,000	0.25	4.25	0.708
7th $1,000	0.25	4.5	0.643
8th $1,000	0.25	4.75	0.594

The amount of the principal subsidy possible will depend on the required duration of repayments, the repayment rate, the size of the advance, the rate of interest, and the pattern of future income receipts.

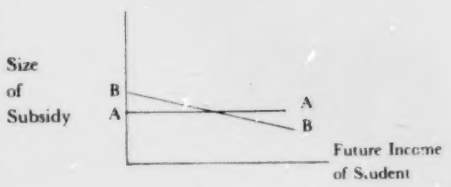
2) Interest Increment Subsidy. An interest increment subsidy can be added to the principal subsidy. In the event that the participant does not earn sufficient income to cover the entire portion of the annual interest, the State would pay the difference as an interest increment subsidy.[7] Because some middle income participants would be eligible for such subsidies during years immediately following graduation, this subsidy is a way to spread benefits to middle income participants if such a policy goal exists. The interest subsidy can be combined with the CMR, DMR, or IPR, and with other possible subsidization schemes.

C. Analysis.

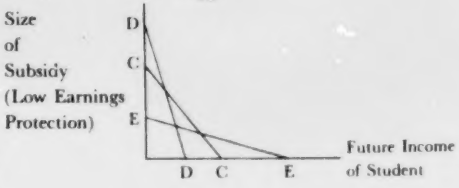
The present system of allocating subsidies in the form of grants based on parental incomes can be assumed to distribute subsidies randomly according to the future income of the student, as represented by AA in figure 1a. This is equivalent to saying that the probability is the same that a participant, no matter where he is in the future income distribution will have had poor parents. There is some evidence, however, which indicates that students with low income parents receive lower incomes, on average, than students from higher income families. Thus, line BB may more accurately represent the subsidy distribution by future income of borrowers; it shows subsidies being

[7] This is not equivalent to the Federal interest subsidy—the difference between the interest rate charged to the student and the actual market rate. Nor is it equivalent to the Federal enrollment subsidy accruing when the government does not add interest accrued to the debt during enrollment. To the extent that the Federal government participates in the Wisconsin program through the use of the dual promissory note, the Federal enrollment and interest subsidies will contribute to total student subsidies.

1a



1b



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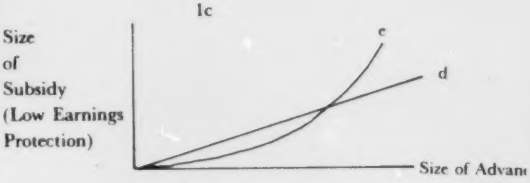


more heavily concentrated at the lower end of the future income distribution.

Assume now that a fixed amount of subsidization is established for this program. The distribution of subsidies for the alternative repayment rate specifications is illustrated in figures 1b and 1c. Suppose the incidence of the CMR subsidy according to the future income of the participant is represented by CC. This implies that principal subsidies go to students whose future incomes are lowest. Since the IPR would concentrate subsidies among future low earners more so than the CMR, the distribution of subsidies would look something like DD where triangle DOD has the same area as triangle COC. Use of the IPR would do an even greater job of concentrating the subsidies. Addition of an interest increment subsidy brings still further changes. Since some portion of the participants will not have high enough incomes to cover the increment in debt due to interest charges during the early years of repayment, the interest increment subsidy spreads the distribution of subsidies towards the middle income range. Thus, combining the CMR with the interest increment subsidy may yield a distribution that looks like EE, in contrast to CC which represents CMR without the interest increment subsidy.

By varying the specifications of a repayment schedule, i.e., raising or lowering the debt forgiveness provision and/or combining the interest increment subsidy provision with one of the several repayment rates, virtually any distribution of subsidies can be obtained. Lines like CC, DD and EE can be concave or convex to the origin and have nearly any slope.

The DMR adds another dimension by varying the subsidy with the size of the debt. Without a CMR or IPR, subsidies are proportional to debt size, as illustrated by line f in figure 1b. However, with a DMR schedule subsidies increase with advance size as shown by line e.

An empirical analysis of alternative subsidization schemes is crucially important for many reasons. Policy considerations may dictate that certain groups be subsidized for equity or policy reasons. The distribution of subsidies may affect other parameters, such as participation rates and loan volume. How subsidies are allocated is likely to affect who borrows—rich or poor, black or white, and others.

D. Empirical Results.

Our empirical investigations have been limited to a highly simplified model of participation, in the hope that the results from this model will enable us to develop more complex models that will yield more accurate empirical statements in subsequent work. For now, we consider six alternative repayment schemes: The CMR, DMR and IPR, each with and without an interest increment subsidy and the SIR with an interest increment subsidy.

The model places all participants into one of five projected income streams, with an equal number of participants in each income stream (quintile). The projected income streams are linear approximations of the median Adjusted Gross Income for each of the five income quintiles corresponding to males with four years of college education. The distribution of the size of the advance accumulated over four years is identical for each quintile. The distribution of participants by size of debt in each quintile is assumed to be as follows: 10 percent with $500 advances, 10 percent with $1,000 advances, 20 percent with $2,000 advances, 30 percent with $3,000 advances, 15 percent with $4,000 advances, 10 percent with $5,000 advances, and 5 percent with $7,500 advances. This particular distribution assumes the absence of any correlation between the advance size and future income. One may question this assumption since higher income

TABLE II

PERCENTAGE DISTRIBUTION OF SUBSIDIES BY FUTURE INCOME QUINTILE

Repayment Rate and Type of Subsidy	Quintile				
	Bottom	2nd	3rd	4th	Top
Principal Subsidy					
CMR	76	24	0	0	0
DMR	65	27	7	0	0
IPR	81	19	0	0	0
Principal Subsidy and Interest Increment Subsidies					
CMR	54	27	15	4	0
DMR	53	27	15	5	0
IPR	56	27	13	4	0

students are more likely to have parents with high incomes and therefore need to be advanced less. The exact relationship remains unclear, however, because students whose parents have high incomes attend more expensive schools and expect higher incomes themselves which may cause them to seek advances as large as the poor student expecting lower future income and going to a less expensive school. To summarize, the combinations of incomes and advance sizes do not seem unreasonable since participants with less than four years of post-secondary education have smaller advances as well as smaller incomes and those with more than four years of post-secondary education have higher incomes but also larger advances. By definition there is no adverse selection since the opt-out rate is the market rate of interest and all low earnings protection is provided through external subsidization.

Several other parameters need specification to round out the model. The maximum repayment period is 25 years. The interest rate to the student (the internal interest rate), the borrowing cost of funds, and the social discount rate (used to find the present value of subsidies) are all set at seven percent. There are no defaults and none of the participants die. The total subsidy target is assumed to be nine percent of loan volume.[8] The only remaining parameter, the repayment rate, can then be calculated.

We next estimate the distribution of the subsidies provided for low earnings protection under each of the various repayment plans. The overall results are presented in Table II, showing the percentage distribution of subsidies by future income. More detailed results for the DMR schedule are given in Table IV which shows for income quintile and debt size the distribution of total debt, borrowers, and subsidies. The top panel gives the results without the interest increment subsidy; the second panel includes this additional subsidy. We shall focus our discussion on the overall distribution of subsidies.

1. CMR Subsidy Distribution. The repayment rate using a constant marginal repayment rate (CMR) is set at 0.5 percent of adjusted gross income per $1,000 advanced. Accordingly, the lowest income quintile receives 76 percent of the subsidy and the second quintile receives the remaining 24 percent. Adding the interest increment subsidy redistributes the subsidy in such a way that the lowest quintile had 54 percent of the

[8] Subsidies for each quintile calculated by summing the discounted values of all repayments during the 25-year repayment period and subtracting them from the total loan volume for each quintile. The total subsidies are the sum of the quintile's subsidies. The targeted subsidy level is reached by iteration.

subsidy, the second quintile, 27 percent, the middle quintile, 15 percent, and the fourth quintile the last four percent. The repayment rate must be increased to 0.58 percent of adjusted gross income per $1,000 advanced because of the interest subsidies.

2. DMR Subsidy Distribution. The schedule of repayment rates for the diminishing marginal repayment rate (DMR) without the interest increment subsidy is:

TABLE III

SCHEDULE OF DIMINISHING MARGINAL REPAYMENT RATES
WITHOUT INTEREST INCREMENT SUBSIDY

Amounts Advanced	Marginal Repayment Rate	Cumulative Repayment Rate	Cumulative Rate per $1,000 Advanced
1st $1,000	1.2%	1.2%	1.2%
2nd $1,000	.5	1.7	.85
3rd $1,000	.25	1.95	.65
4th $1,000	.15	2.1	.525
5th $1,000	.1	2.2	.44
6th $1,000	.1	2.3	.38
7th $1,000	.1	2.4	.34
8th $1,000	.1	2.5	.312

As before, the first column is the repayment rate for the last $1,000 advanced, the second column shows for each advance size the total percentage of income needed for repayment, and the last column is the average repayment rate for each $1,000 by advance size.

The lowest quintile receives 65 percent of the subsidy, the second quintile, 27 percent, and the middle quintile, 7 percent. Since the subsidy also depends on the advance size it is perhaps more meaningful to look at the subsidy stratified by advance size and income as shown in the top panel of Table IV. Those individuals with the smallest advances, even in the lowest income classes, receive no subsidy while middle income participants with $7,500 advances receive 7 percent of all subsidies. Students with $7,500 advances make up only 5 percent of the population and 13 percent of total advances but receive 38 percent of the subsidies. The $5,000 participants receive 29 percent, the $4,000 participants receive 20 percent and the $3,000 participant, representing 30 percent of both the participants and total advances, receive 12 percent of the subsidy.

TABLE IV

DISTRIBUTION OF SUBSIDY—DMR; SIR

DMR WITHOUT INTEREST INCREMENT SUBSIDY

Debt Size	Percent of Total Advances					Percent of Participants					Percent of Subsidy				
	low	2	3	4	high	low	2	3	4	high	bottom	2nd	3rd	4th	top
$1,000	3%	3%	3%	3%	3%	2%	2%	2%	2%	2%	0%	0%	0%	0%	0%
2,000	3	3	3	3	3	4	4	4	4	4	0	0	0	0	0
3,000	6	6	6	6	6	6	6	6	6	6	12	0	0	0	0
4,000	4	4	4	4	4	3	3	3	3	3	16	4	0	0	0
5,000	3	3	3	3	3	2	2	2	2	2	19	10	0	0	0
7,500	2.5	2.5	2.5	2.5	2.5	1	1	1	1	1	18	13	7	0	0
											65	27	7	0	0

TABLE IV (Continued)

DISTRIBUTION OF SUBSIDY—DMR; SIR

DMR WITH INTEREST INCREMENT SUBSIDY

	low	2	3	4	high	low	2	3	4	high	bottom	2nd	3rd	4th	top
$1,000	.3%	.3%	.3%	.3%	.3%	2%	2%	2%	2%	2%	0%	0%	0%	0%	0%
2,000	3	3	3	3	3	4	4	4	4	4	3	1	0	0	0
3,000	6	6	6	6	6	6	6	6	6	6	11	6	4	0	0
4,000	4	4	4	4	4	3	3	3	3	3	12	6	3	1	0
5,000	3	3	3	3	3	2	2	2	2	2	13	6	4	1	1
7,500	2.5	2.5	2.5	2.5	2.5	1	1	1	1	1	14	8	4	2	2
											53	27	15	4	3

SIR WITH INTEREST INCREMENT SUBSIDY

	low	2	3	4	high	low	2	3	4	high	bottom	2nd	3rd	4th	top
$1,000	.3%	.3%	.3%	.3%	.3%	2%	2%	2%	2%	2%	1%	0%	0%	0%	0%
2,000	3	3	3	3	3	4	4	4	4	4	4	1	0	0	0
3,000	6	6	6	6	6	6	6	6	6	6	14	5	1	0	0
4,000	4	4	4	4	4	3	3	3	3	3	12	6	2	1	0
5,000	3	3	3	3	3	2	2	2	2	2	12	7	3	1	0
7,500	2.5	2.5	2.5	2.5	2.5	1	1	1	1	1	16	8	5	2	1
											58	26	11	4	1

Adding the interest increment subsidy spreads the subsidies out to more high income participants and to those with smaller advances. Even the high stipulated repayment rates for small advances may not be enough to cover the annual interest increment during the early years of participation. The resulting repayment schedule with the interest increment subsidy is:

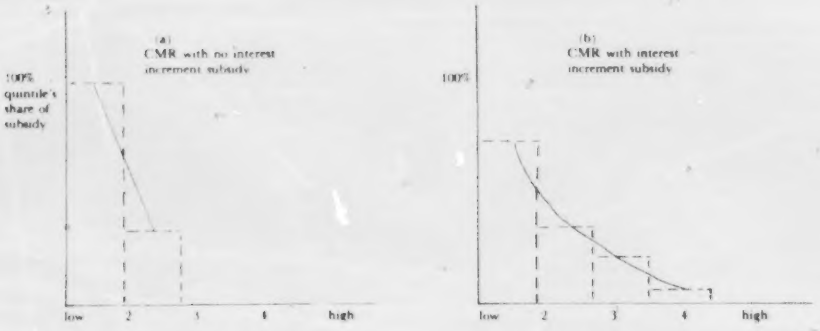
Amounts Advanced	Marginal Repayment Rate	Cumulative Repayment Rate	Cumulative Rate per $1,000 Advanced
1st $1,000	1.2%	1.2%	1.2%
2nd $1,000	.6	1.8	.9
3rd $1,000	.3	2.1	.7
4th $1,000	.2	2.3	.525
5th $1,000	.2	2.5	.5
6th $1,000	.2	2.7	.45
7th $1,000	.2	2.9	.414
8th $1,000	.2	3.1	.3875

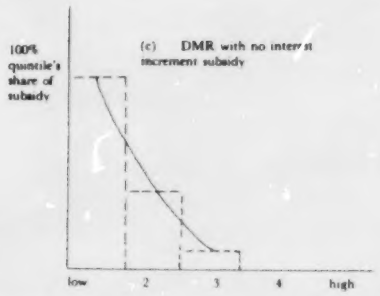
Although the major portion of the subsidies still go to the lowest quintile, as can be seen in the middle panel of Table IV, that quintile's share falls from 65 percent to 53 percent. The second quintile's share remains the same at 27 percent but those with $3,000 and $2,000 advances who previously received no subsidy now gain 6 percent of all subsidies. Middle quintile participants receive 15 percent of all subsidies spread over four different advance sizes. Without the interest increment subsidy only those with the $7,500 advance receive any subsidy in that quintile. The fourth quintile receives 4 percent of the subsidies and the highest quintile, 2 percent. Participants with a $7,500 advance receive only 29 percent of all subsidies compared to 38 percent without the interest increment subsidy. Those with $5,000 advance receive 25 percent of the subsidy and $4,000 participants, 22 percent. The $3,000 participants, representing 12 percent of the population, received 12 percent of the subsidies without the interest increment subsidy; under this scheme their share rises to 20 percent.

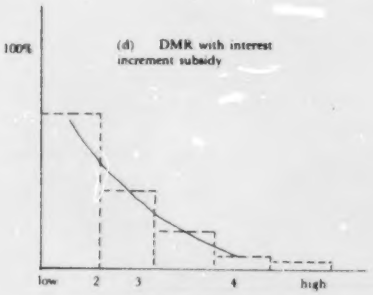
3. SIR Distribution of Subsidies. The repayment rate for the Straight Income Repayment rate (SIR) with the interest increment subsidy yielding total subsidies equal to the other repayment plans is: r = .04 x AGI - $120. The lowest quintile receives 58 percent of the subsidies, the next quintile, 26 percent, the middle quintile, 11 percent, and fourth quintile, 4 percent. Like the DMR schedule, subsidies vary according to the size of advance. As shown in the third panel of Table IV, those individuals with smaller advances, even in the low income categories, receive a proportionately smaller subsidy than middle income participants with large advances of $7,500. Those with $7,500 advances comprise only 5 percent of all participants and 10 percent of total advances but receive 32 percent of the subsidies. Individuals with $3,000 advances make up 30 percent of the population and 30 percent of the total advances but receive only 20 percent of the subsidies. Relative to the DMR with the interest increment subsidies, the SIR targets the subsidies more heavily in the lowest quintile (58 vs. 53 percent) and spreads the subsidies toward those participants with smaller advances.

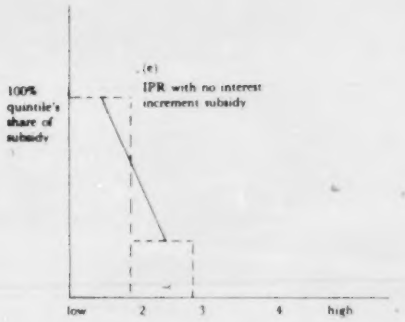
4. IPR Distribution of Subsidies. The income progressive repayment rate (IPR) without the interest increment subsidy is r = .0067 x AGI - $20 per $1,000 advanced. As shown in Table II, the lowest quintile receives 81 percent of the subsidy and the next highest quintile receives the remaining 9 percent. When the interest increment subsidy is added, r = .0082 x AGI - $20 for each $1,000 advanced. The fall in the share of the subsidy to the lowest quintile is particularly sharp, dropping from 81 percent without the subsidy to 56 percent with the subsidy. The share of the next lowest quintile rises from 19 percent to 27 percent, the middle quintile now receives 13 percent, and the fourth quintile, 4 percent of the subsidies.

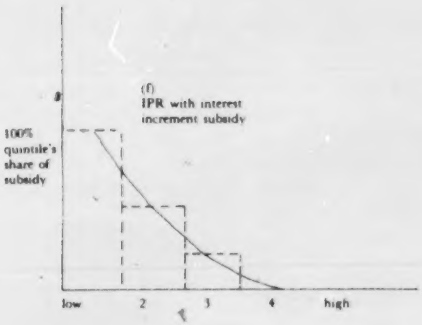
FIGURE II

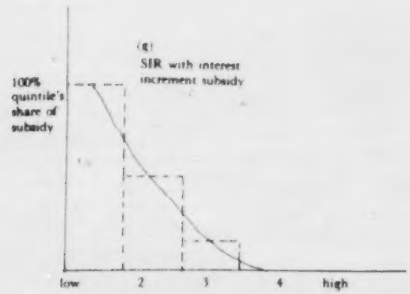



100% quintile's share of subsidy
(c) DMR with no interest increment subsidy
low
2
3
4
high


100%
(d) DMR with interest increment subsidy
low
2
3
4
high


100% quintile's share of subsidy
(e) IPR with no interest increment subsidy
low
2
3
4
high


100% quintile's share of subsidy
(f) IPR with interest increment subsidy
low
2
3
4
high


100% quintile's share of subsidy
(g) SIR with interest increment subsidy
low
2
3
4
high

5. Comparison of Results. None of these examples are superior or inferior to any other example without some policy criteria. The total subsidy for all participants is the same—only the distribution of the repayment burden among income categories varies and, consequently, the distribution of the subsidies changes. An idea of the equality or inequality of the subsidies is probably best obtained by scanning Figure II. The height of each bar indicates the percentage share of the total subsidy by income quintile. The lines connecting the midpoints of each bar visualize the underlying continuous distribution and are comparable to those shown in Figure 1b.

Of particular interest is the fact that whatever differences in the distribution of subsidies result when the debt forgiveness subsidy is used above, addition of the interest increment subsidy not only washes out these differences but in the process shifts the distribution of subsidies away from those individuals who expect lower future incomes. Tying subsidies to the interest rate through either the interest increment subsidy, the Federal enrollment subsidy or Federal interest subsidy spreads the subsidies to those with higher future incomes.

Now that we have the six alternative repayment rates and the six alternative subsidy distributions, the assumption of fixed participation, regardless of the choice of repayment plans, must be questioned. Plans with low annual repayment rates, such as the CMR with the interest increment subsidy, will be attractive to those who expect low future incomes. Interest increment subsidies will be more appealing to borrowers who expect higher future incomes since they are more likely to receive some benefit from the program. On the other hand, they may prefer lower annual repayment rates to some small probability of receiving a small subsidy. The DMR schedule may encourage more borrowing because each extra $1,000 of advance carries a smaller annual repayment burden. The repayment formula for the IPR schedule "appears" to be higher than the CMR rate and thus may discourage borrowing. Viewed in another way, the IPR would be preferred by those who are most unsure of their future income and want to minimize the annual repayment burden in the event of low income.

The effects of each plan on the dollar volume of total advances will be difficult to determine because: 1) the direction of the change is unknown, e.g., a plan may discourage borrowers who expect low incomes but at the same time increase average advance size for middle income participants who can now afford more expensive schools; and 2) there is a dynamic problem because changes in the distribution of borrowers and advance sizes in turn affects the repayment rates and subsidy levels.

IV. Next Steps in Research

Much more work needs to be done to assess the feasibility and desirability of a state-supported and operated program with income contingent provisions for students attending post-secondary institutions. The cost of the program, the source of funds, and the appropriate interest rate to charge, are but a few of the many issues to be resolved.

Our next efforts will be devoted to learning more about the intergenerational dimensions of the redistribution of benefits. This will involve estimating how the subsidies provided through such a program as this will be distributed, not only with respect to the future income of those who participate but also with respect to the current income of students' parents. We believe that the resulting distribution can be approximated by taking present debt size by parental income of students and then grafting it onto the results we have presented in this paper. Of course, this is only a first step because it ignores changes in behavior pat-

terns that might result from implementing a plan with the provisions outlined in this paper. Nevertheless, it seems particularly important to examine the possible distribution of benefits, because this may be a key consideration in helping people to decide whether or not to push ahead with the kind of program described here.

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